PART I: EXECUTIVE SUMMARY/OVERVIEW

This report, the *1998 Kansas Water Quality Assessment*, also known as the 305(b) Report, is the biennial assessment of the state's surface water quality as required by 33 USC 466 *et seq,* the Federal Water Pollution Control Act, commonly referred to as the Clean Water Act. The guidance by U. S. Environmental Protection Agency (EPA) for the preparation of this report provided three options for reporting. The Kansas Department of Health and Environment (KDHE) elected the second option which is to provide in even years, an electronic report accompanied by an abbreviated narrative report. The abbreviated narrative report contains only the information required by law that has **changed** from the last report (1996 Kansas Water Quality Assessment, December 1996) and a simple reference to that report.

The Kansas Department of Health and Environment (KDHE) assessed the water quality for the period of 1996-1997, of 15,620 miles of streams, of which 1,715 miles were evaluated and 13,914 monitored. A total of 181,337 lake acres were assessed. Of these, 169,714 acres were monitored and the conditions of an additional 11,623 lake acres were evaluated using best professional judgement.

An assessment of cumulative designated use stream mileage revealed that 88% of the designated uses were fully or partially supported. Of the assessed streams, 31% (in stream miles) supported all designated uses, while 69% supported at least one or more of its designated uses (in stream miles). Of the assessed lakes, 34% of the total acres were fully supporting but threatened for at least one designated use, and 66% were impaired for one or more uses.

The *1996 Kansas Water Quality Assessment Report* included five years of data (1991-1995) and the assessment of the aquatic life support use included both acute and chronic applications. This *1998 Kansas Water Quality Assessment Report* includes two years of data (1996-1997) and only acute aquatic life use support application. This assessment is consistent with the 1998 US EPA guidance and reflects the manner in which most states have prepared past 305(b) reports.

The assessments contained in this report are consistent with the application of the 1994 Kansas surface water quality standards. Some changes in the 1998 report reflect a more consistent application of the State's water quality standards, namely: total dissolved solids (TDS) were not evaluated since there are no criteria for TDS in the standards; total suspended solids (TSS) were not evaluated by a numeric criterion; and the high flow exclusion was considered in evaluating streams for compliance with the fecal coliform recreation criteria.

The major causes of nonsupport for streams, in order of prevalence, are fecal coliform, organic enrichment, sulfates, and chlorides. The major causes for lake impairments were sediments, turbidity, nutrients/eutrophication, and taste and odor problems

Sources responsible for widespread pollutant loadings and beneficial use impairments of streams include agriculture (nonirrigated and irrigated crop production, and intensive animal feeding operations), natural sources, hydromodification, and groundwater withdrawal. Major sources for lake impairment included agriculture and natural sources.

Of the assessed lake acreage in Kansas, almost 68% were stable over time, while slightly more than 21% appeared to be undergoing measurable eutrophication over time. Very few lakes in the state, 4% of total lake acres, showed any appreciable improvement in trophic state condition during this reporting cycle. Agriculture, municipal point sources, and natural sources were the primary contributing factors to lake eutrophication.

During the 1996-1997 reporting cycle, high nitrate concentrations accounted for about 82% of the documented exceedences of the federal drinking water maximum contaminant levels (MCLs) in groundwater. The majority of the samples with excessive levels of nitrate were obtained from shallow wells (less than 100 feet) or in wells located in areas of sandy soil and high water tables. Other isolated concerns of groundwater contamination included the presence of volatile organic compounds, heavy metals, petroleum products and/or bacteria. The major sources of these contaminants included active industrial facilities, spills, leaking storage tanks, mineral extraction activities, and agricultural activities.

In Kansas 70% of public water supplies use groundwater as their only source of water. Four percent of public supplies use a combination of groundwater and surface water. During the 1996 calendar year, 94% of the public water supplies utilizing groundwater had no MCL (maximum contaminant levels) exceedences. Of the 6% that did, 4% of the exceedences were for nitrate. Selenium and radium accounted for the remaining 2% of the supplies that had MCL exceedences.

The imposition of more stringent permits limits and the resulting upgrades of municipal and industrial wastewater treatment facilities continue to result in notable improvements in surface water quality. As the number of point sources causing or contributing to significant water quality impairments continues to decline, future attention will necessarily shift to the remaining sources, primarily nonpoint source related water quality problems. It is anticipated that watershed pollution control efforts, predicated on the development of TMDLs (total maximum daily loads) and on the allocation of allowable pollutant loadings among point, nonpoint and natural sources, will play an increasingly important role in the abatement of surface water pollution in Kansas.

PART II: BACKGROUND

Updated data is provided in the tables that follow. There are no significant changes since the 1996 305(b) Report, December, 1996.

Table 1.	Kansas Atlas
Table 2.	Number of Active KWPC and NPDES Permits
Table 3.	Permit Compliance Record
Table 4.	Summary of Local Environmental Code Adoption Trough
Table 5.	KDHE Cooperative Funding for Construction of Municipal Wastewater Treatment Facility Upgrades and Expansions, 1996-97

There are no significant changes in state concerns and recommendations from the 1996 305(b) Report, December, 1996.

Table 1. Kansas Atlas

TOPIC	VALUE
State population	2,554,047
State surface area in square miles	81,778
Number of major river basins	12
Total number of interior stream miles (EPA RF3/DLG) Number of border stream miles Number of perennial stream miles Number of intermittent stream miles Number of ditch and canal miles	134,338 120 23,731 110,225 382
Number of lakes/reservoirs/ponds (publicly owned)	307
Acres of lakes/reservoirs/ponds (publicly owned)	181,337
Acres of public freshwater wetlands	35,607

Table 2. Number of Active KWPC and NPDES Permits*

NUMBER OF PERMITTED FACILITIES					
Municipal and Commercial		**Industrial/Federal**		**Agricultural**	
Total Municipal and Commercial KWPC (non-overflowing)	504	Total Industrial/ Federal KWPC (non-overflowing)	139	Agricultural NPDES	380
Discharging Lagoons	298	Total Industrial (discharging)	488	Agricultural State	1482
Mechanical Treatment Facilities	196			Agricultural Certifications	1106
Total	**998**		**627**		**2968**

KWPC = Kansas Water Pollution Control
NPDES = National Pollutant Discharge Elimination System
* as of January 1, 1998

Table 3. Permit Compliance Record. "Absolute" Compliance for WWTFs Excluding Non-Discharging Lagoons.

YEAR	TYPE OF FACILITY	
	MUNICIPAL & COMMERCIAL	INDUSTRIAL
1996	89%	93%
1997	NA	NA
TOTAL NUMBER	**494**	**488**

WWTF = Wastewater Treatment Facility
NA = not available

Table 4. Summary of Local Environmental Code Adoption Through 1997

STATUS	NUMBER
Adopted and Being Administered	85
Approved for Adoption	2
Being Developed	16
No Action	2

Table 5. KDHE Cooperative Funding for Construction of Municipal Wastewater Treatment Facility Upgrades and Expansions. Monetary units given in millions of dollars.

YEAR OF FUNDING (FFY)	KWPCRF*		CDBG**		RD***
	BASIC	LEVERAGED	FEDERAL	TOTAL	FEDERAL
1996	22.363	0	1.964	5.821	2.425
1997	20.949	28.3	4.615	8.944	3.215
Total	**43.312**	**28.3**	**6.579**	**14.765**	**5.64**

* KWPCRF= Kansas Water Pollution Control Revolving Fund
** CDBG = Community Development Block Grant
*** RD = Rural Development

PART III: SURFACE WATER ASSESSMENT

The KDHE maintains five primary water quality monitoring programs. These address (1) the chemical and physical properties of streams and rivers, (2) the biological properties of streams

and rivers, with emphasis on aquatic and semiaquatic macroinvertebrate communities, (3) the physiochemical and biological properties of lakes and wetlands, (4) contaminant concentrations in the tissues of bottom-feeding fish, and (5) the physiochemical properties of groundwater. There have been no significant changes in the monitoring programs from those described in the December, 1996 305(b) Report. The current Section 106 monitoring strategy is included as Appendix A. The accompanying maps delineate sampling stations.

Figure 1. Stream Chemistry Monitoring Network
Figure 2. Biological Monitoring Network
Figure 3. Lakes and Wetland Monitoring Network
Figure 4. Fish Tissue Monitoring Network
Figure 5. Groundwater Monitoring Network

The assessments of streams and rivers were conducted using data from calendar years 1996 and 1997. The 1996 report covered five years of data (1991-1995) in anticipation of a five year reporting cycle. The assessments were based upon designated uses in the 1994 Kansas surface water quality standards (K.A.R. 28-16-28b through K.A.R. 28-16-28f) and utilized the criteria stated in those standards. The 1996 305(b) report provided two assessments, acute and chronic, for aquatic life use support. The 1998 assessment addresses only acute criteria. The ambient sampling data consists of grab samples taken, for the most part, every two months and do not lend themselves to chronic assessments based on on 7-day or 30-day averaging periods. Kansas has a narrative criterion for total suspended solids (TSS)(K.A.R. 28-16-28e(c)(2)(D)). Assessments for TSS were made basin-wide and a basin summary of data is presented in Appendix B. An assessment of total dissolved solids (TDS) does not appear in the 1998 report; Kansas does not have a criterion for TDS in the surface water quality standards. Fecal coliform data were evaluated, utilizing flow data where available, to consider high flow exclusions as provided in K.A.R. 28-16-28c(c)(2).

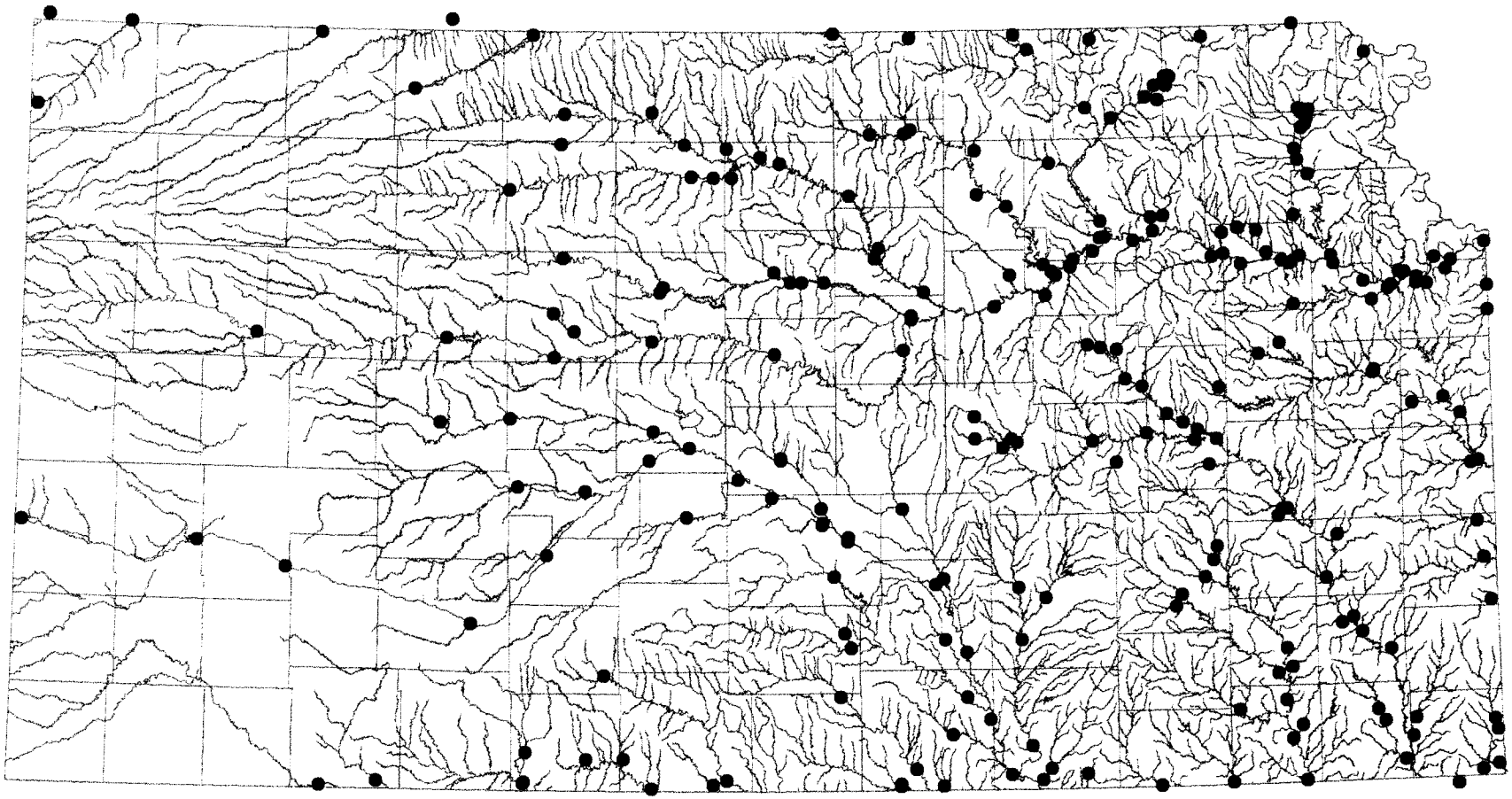
A flow chart of the decision process is included as Appendix C.

Summary tables, although not required, have been provided as follows:

Table 6a. Summary of Fully Supporting, Threatened and Impaired Stream Miles
Table 6b. Summary of Fully Supporting, Threatened, and Impaired Lakes (in acres)
Table 7a. Individual Use Support Summary for Streams
Table 7b. Individual Use Support Summary for Lakes
Table 8a. Total Stream Mileage Impaired by Various Cause Categories
Table 8b. Total Lake Acres Impaired by Various Cause Categories
Table 9a. Total Stream Mileage Impaired by Various Source Categories
Table 9b. Total Lake Acres Impaired by Various Source Categories
Table 10. Trophic Status of Lakes Assessed During This Reporting Cycle
Table 11. Trophic State Trends in Lakes
Table 12 List of Contaminants Considered in the Assessment
Table 13. Summary of Domestic Water Supply Use Impairments in Streams
Table 14. Summary of Domestic Water Supply Use Impairments in Lakes

In compliance with Section 314(a)(2) of the Clean Water Act, an assessment report of lake water quality is presented in Appendix D.

FIGURE 1. STREAM CHEMISTRY MONITORING NETWORK



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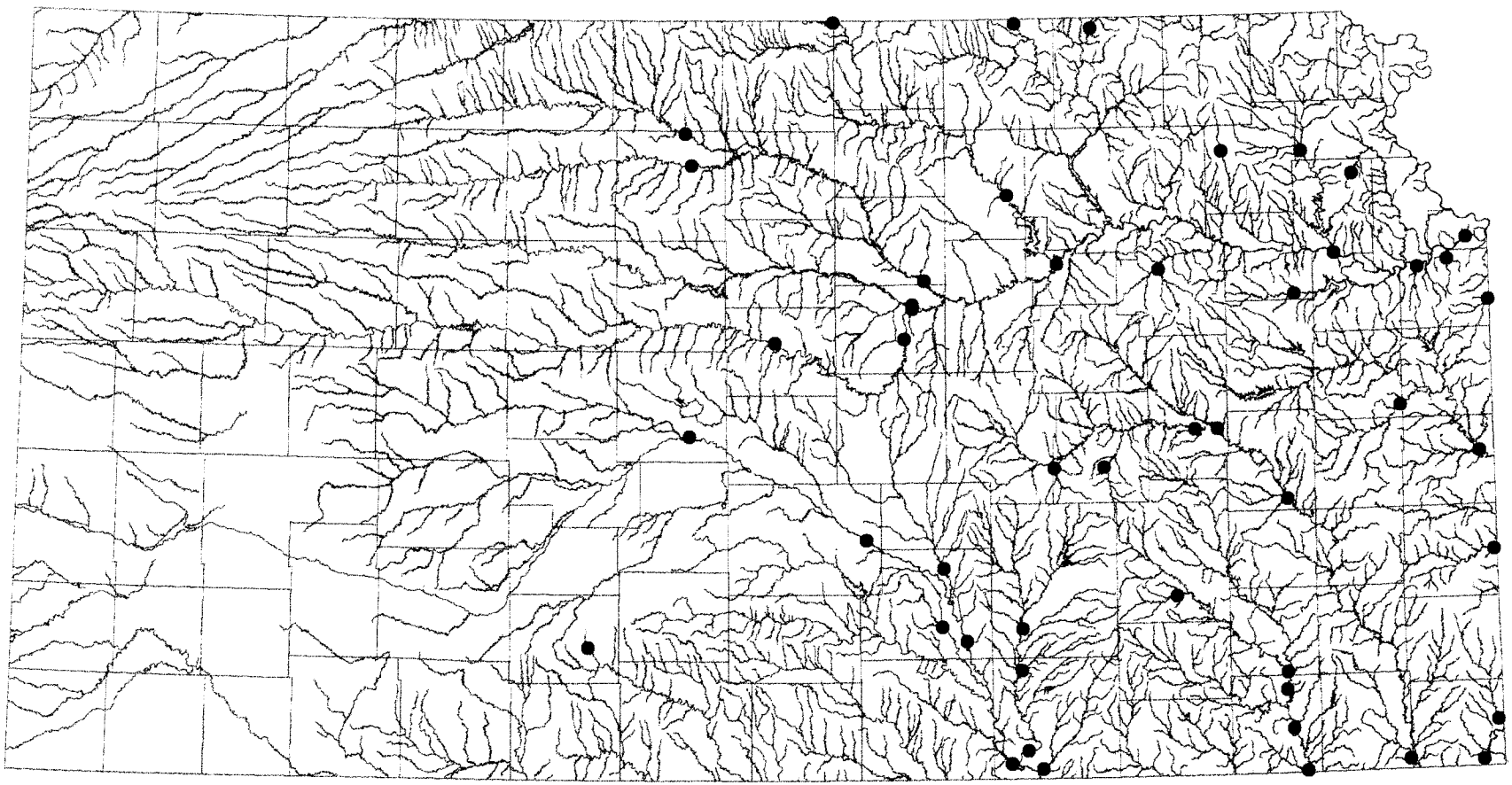
● Stream stations sampled in 1996-1997
County boundaries
Surface waters

FIGURE 2. STREAM BIOLOGICAL MONITORING NETWORK



KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT

1998 305(b) Report

● Biological stations sampled in 1995-1996
Surface waters
County boundaries

FIGURE 3. LAKE AND WETLAND MONITORING NETWORK

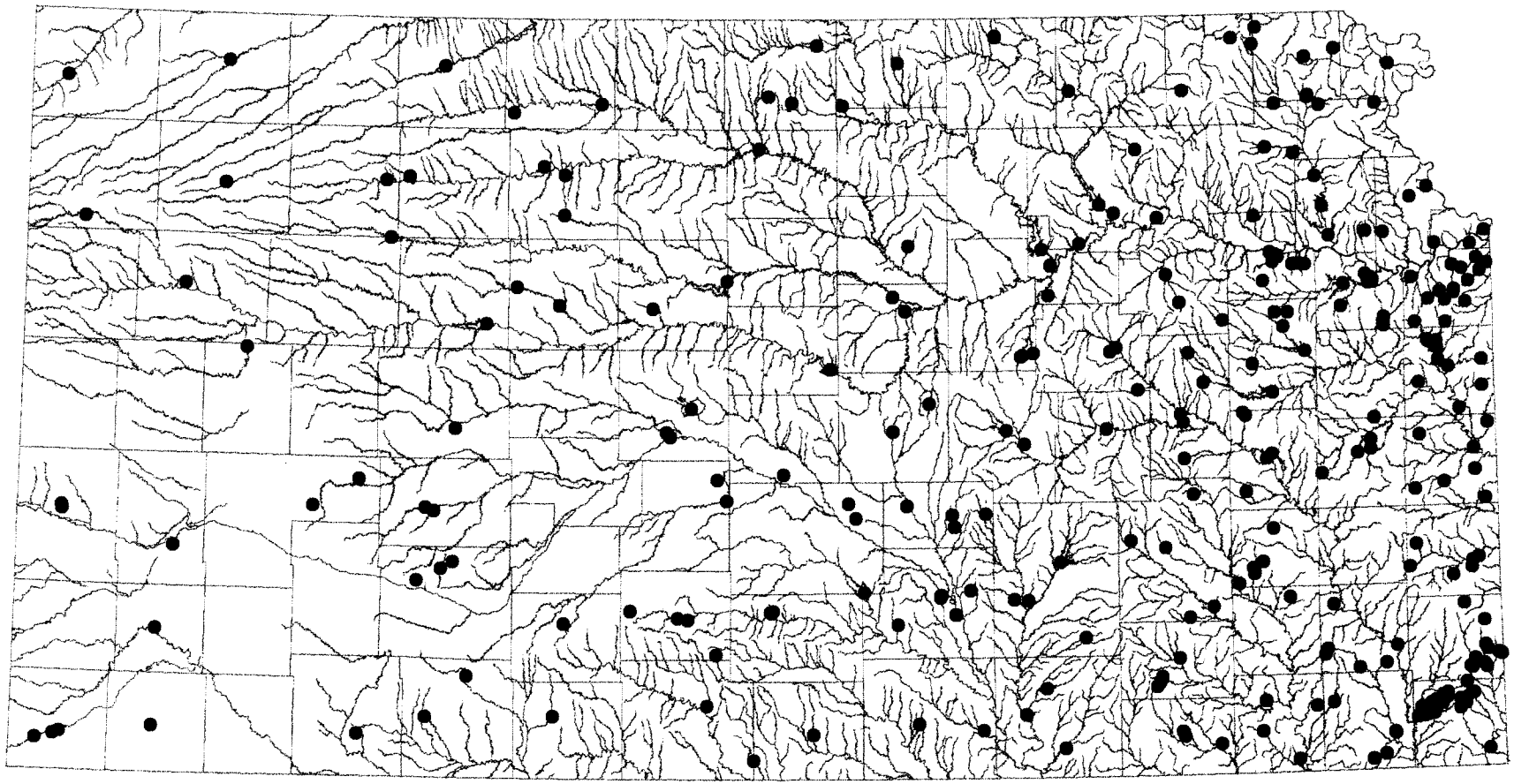


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FIGURE 4. FISH TISSUE MONITORING NETWORK

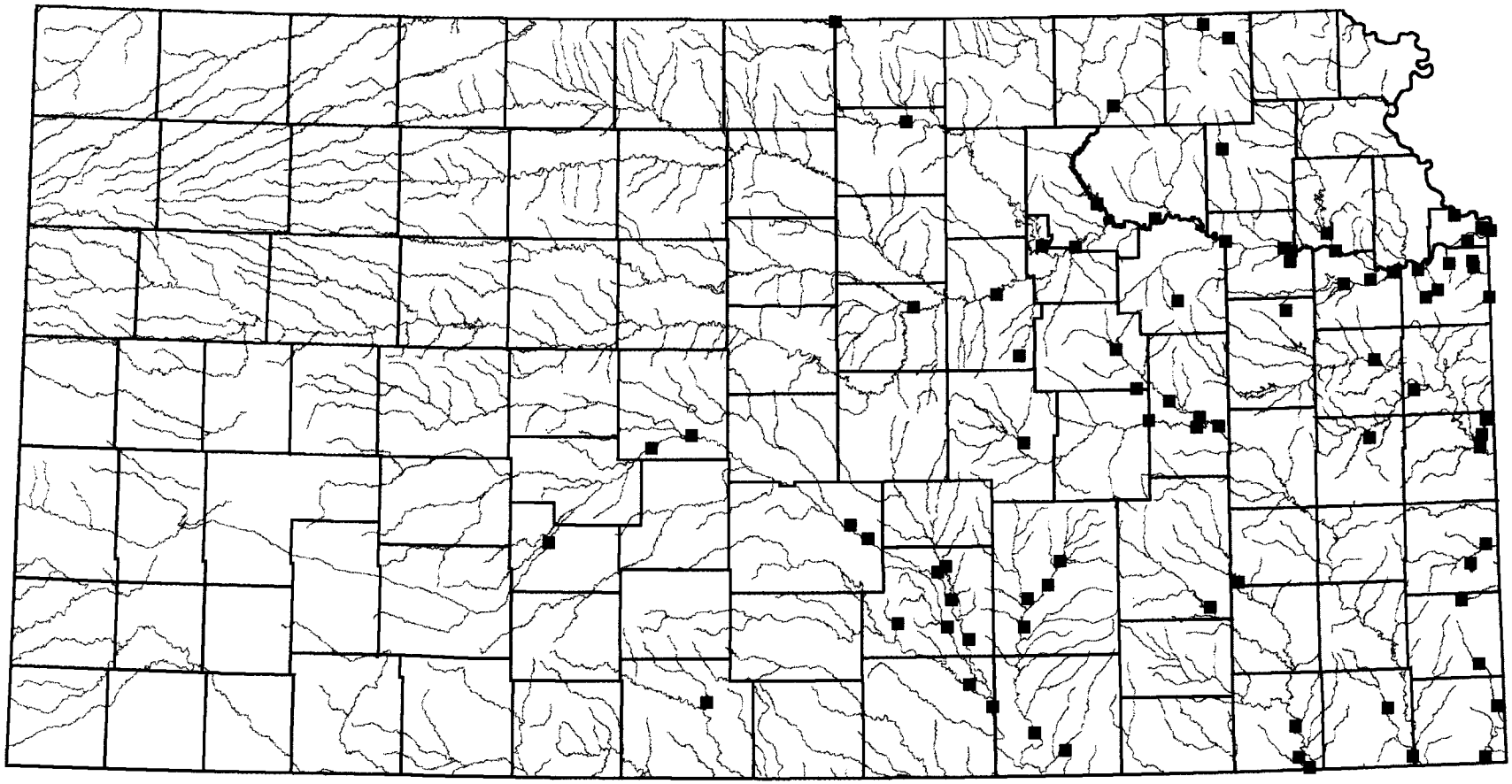

FIGURE 5. GROUNDWATER MONITORING NETWORK

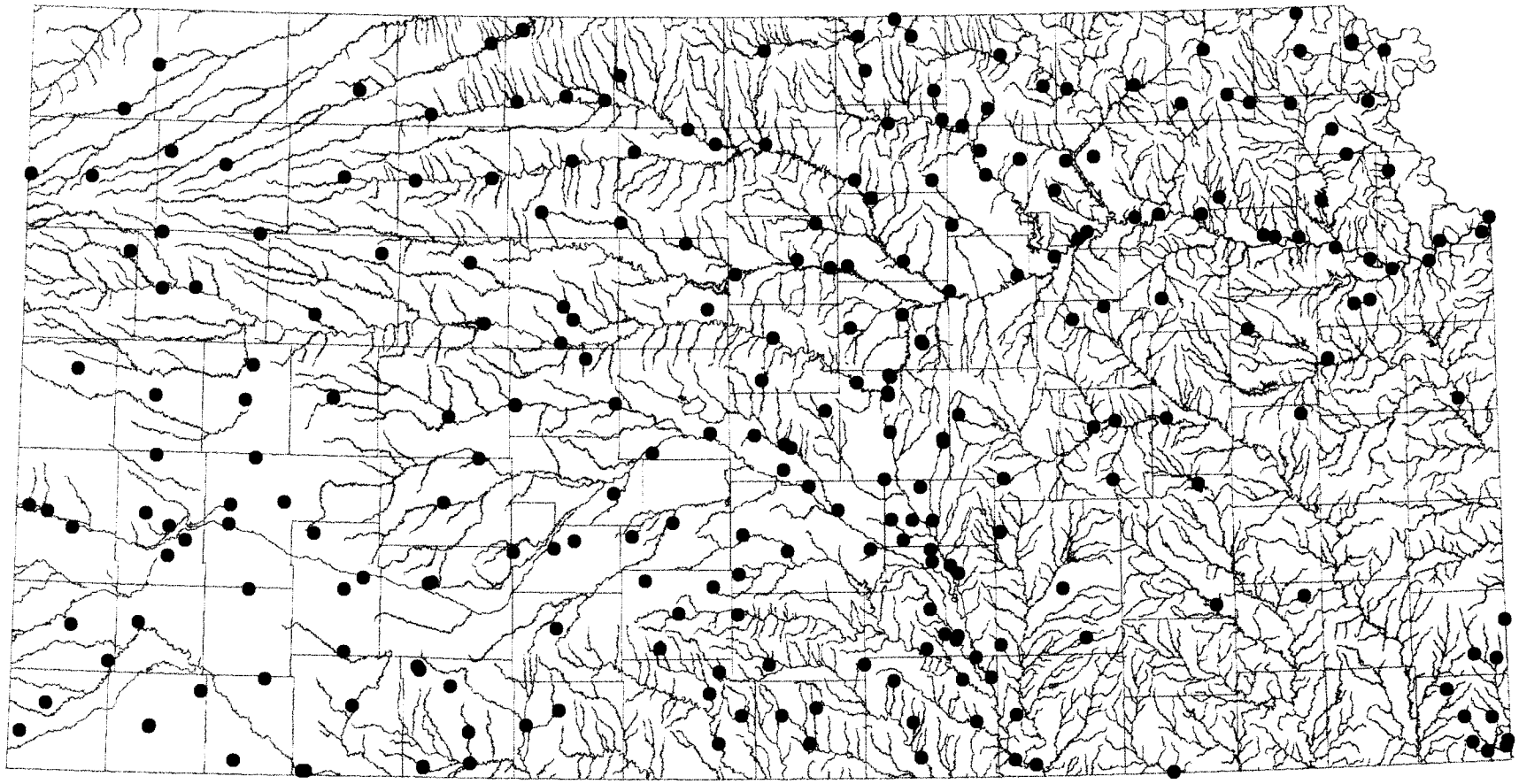

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Table 6a. Summary of Fully Supporting, Threatened, and Impaired Streams Miles

DEGREE OF USE SUPPORT	ASSESSMENT CATEGORY		TOTAL ASSESSED SIZE (MILES)
	EVALUATED	MONITORED	
Size Fully Supporting All Assessed Uses	477	4,435	4,912
Size Fully Supporting All Assessed Uses but Threatened for at Least One Use	0	0	0
Size Impaired for One or More Uses	1,238	9,470	10,708
TOTAL ASSESSED	1,715	13,905	15,620

Table 6b. Summary of Fully Supporting, Threatened, and Impaired Lakes (in acres)

DEGREE OF USE SUPPORT	ASSESSMENT CATEGORY		TOTAL ASSESSED ACRES
	EVALUATED	MONITORED	
Fully supporting all uses	0	0	0
Supporting but threatened for at least one use	8,136	52,821	60,957
Size impaired for one or more uses	3,487	116,893	120,380
Total size assessed	11,623	169,714	181,337

Table 7a. Individual Use Support Summary for Streams (in miles)

GOALS	USE	SIZE ASSESSED	SIZE FULLY SUPPORTING	SIZE FULLY SUPPORTING BUT THREATENED	SIZE PARTIALLY SUPPORTING	SIZE NOT SUPPORTING	SIZE NOT ATTAINABLE
PROTECT AND ENHANCE ECOSYSTEMS	Aquatic Life (acute only)	15,620	11,342	0	2,876	1,402	0
PROTECT AND ENHANCE PUBLIC HEALTH	Fish Consumption	836	604	0	0	232	0
	Shell fishing	*	*	*	*	*	*
	Swimming	*	*	*	*	*	1,697
	Secondary Contact	15,426	7,575	0	6,170	1,681	0
	Domestic Water Supply	6,825	4,038	0	244	2,543	*
SOCIAL AND ECONOMIC	Agricultural**	*	*	*	*	*	*
	Cultural or Ceremonial	*	*	*	*	*	*
	State Defined						
	1. Irrigation	6,488	6,066	0	238	184	*
	2. Livestock	6,541	6,183	0	150	208	*
CUMULATIVE MILEAGE		51,736	35,808	0	9,678	6,250	1,697

* = category not applicable
0 = category applicable but size of waters in category is zero
** = see state defined below

Table 7b. Individual Use Support Summary for Lakes (in acres)

GOALS	USE	SIZE ASSESSED	SIZE FULLY SUPPORTING BUT THREATENED	SIZE PARTIALLY SUPPORTING	SIZE NOT SUPPORTING	SIZE NOT ATTAINABLE
Protect & Enhance Ecosystems	Aquatic Life (acute criteria only)	181,337	92,951	85,137	3,249	0
Protect & Enhance Public Health	Fish Consumption	45,107	45,106	0	1	0
	Shellfishing	*	*	*	*	*
	Swimming	181,337	88,630	88,362	4,345	0
	Secondary Contact	181,337	166,728	11,724	2,885	0
	Domestic Water Supply	181,337	85,326	58,094	37,917	-
Social & Economic Enhancement	Agricultural (irrigation)	181,337	164,756	11,434	5,147	-
	Agricultural (livestock)	181,337	167,052	11,534	2,751	-
	Cultural	*	*	*	*	*

* = category not applicable 0 = category applicable, but size of waters in category is zero

\- = category applicable, no data available

TABLE 8a. Total Stream Mileage Impaired by Various Cause Categories

Cause Category	Stream Mileage Impacted by Cause Categories	
	Major Impact[1]	Moderate/Minor Impact[2]
Cause unknown	*	*
Unknown toxicity	*	*
Pesticides	*	*
Priority organics	*	*
Nonpriority organics	*	*
Metals	345	141
Ammonia	*	16
Chlorine	*	*
Other inorganics	2,283	186
Nutrients/eutrophication	*	104
pH	281	979
Siltation	*	172
Organic enrichment/low DO	497	2,425
Salinity/TDS/chlorides	1,364	99
Thermal modifications	*	2
Flow alterations	*	*
Other habitat alterations	*	*
Pathogen indicators	1,681	6,169
Radiation	*	*
Oil and grease	*	*
Taste and odor	*	*
Suspended solids	*	*
Noxious aquatic plants	*	*
Total toxics	*	*
Turbidity	*	*
Exotic species	*	*
Other (specify)	*	*

* = category not applicable

[1] = indicates nonsupport for designated use
[2] = indicates partial support for designated use

Table 8b. Total Lake Acres Impaired by Various Cause Categories

CAUSE CATEGORY	ACRES BY CONTRIBUTION TO IMPAIRMENT	
	MAJOR	MODERATE/MINOR
Cause unknown	0	0
Unknown toxicity	-	-
Pesticides	16,019	6,191
Priority organics	-	-
Nonpriority organics	-	-
Metals	349	245
Ammonia	-	-
Chlorine	-	-
Other inorganics (fluoride)	11	115
Nutrients/eutrophication	21,818	142,748
pH	50	16,043
Siltation	*	*
Organic enrichment/low DO	7	9,429
Salinity/TDS/chlorides	9,191	9,008
Thermal modifications	-	-
Flow alterations	396	11,332
Other habitat alterations	-	-
Pathogen indicators	370	208
Radiation	-	-
Oil and grease	-	-
Taste and odor**	20,566	?**
Suspended solids	50,118	1,045
Noxious aquatic plants	527	2,065
Total toxics	-	-
Turbidity	50,118	1,045
Exotic species	-	-
Other (specify)	-	-

- = Category applicable, no data available.
* = Statewide problem, no direct measurements available
** = Reflects problems severe enough to request KDHE assistance. Other

TABLE 9a. Total Stream Mileage Impaired by Various Source Categories

Source Category	Contribution to Impairment		Source Subcategory	Contribution to Impairment	
	Major[1]	Minor[2]		Major[1]	Minor[2]
Industrial Point Sources	171	15			
Municipal Point Sources	496	1400			
Combined Sewer Overflows	51	84			
Agriculture	4,017	5,808	Nonirrigated Crop Production Irrigated Crop Production Intensive Animal Feeding Operations	 2,098 2,145	283 51 6,689
Urban Runoff/Storm Sewers	258	355			
Resource Extraction	964	67	Petroleum Activities Mine Tailings Abandoned Mining	943 84	 51 15
Hydromodification	1,309	518	Dredging Upstream Impoundment Flow Regulations/Modification	 134 1,309	3 132 516
Highway Maintenance Runoff	18	25			
Sediment Resuspension	32				
Natural Sources	3,445	951			
Salt Storage Sites		68			
Groundwater Withdrawal	1,309	384			
Unknown Source		110			

[1] = indicates nonsupport for designated use

[2] = indicates partial support for designated use

Table 9b. Total Lake Acres Impaired by Various Source Categories

SOURCE CATEGORY	CONTRIBUTION TO IMPAIRMENT	
	MAJOR	MODERATE/MINOR
Industrial Point Sources	-	-
Municipal Point Sources	30,180	110,500
Combined Sewer Overflows	-	-
Agriculture	38,199	118,931
Silviculture	-	-
Construction	-	-
Urban Runoff/Storm Sewers	361	7,214
Resource Extraction	1,390	647
Land Disposals	-	-
Hydromodification	3,445	17,418
Habitat Modification	-	-
Marinas	-	-
Atmospheric Deposition	-	-
Contaminated Sediments	-	-
Unknown Source	0	0
Natural Sources*	18,998*	36,256*
Other (specify)	-	-

- = Category applicable, no data available.
* = Refers mainly to in-lake ecophysiological processes (processes secondary to eutrophication, for instance), wind resuspension phenomena, and climate variations, with very little actual background pollution loading from watersheds included.

Table 10. Trophic Status of Lakes Assessed During This Reporting Cycle (Percent of total in parentheses)

TROPHIC STATUS	NUMBER OF LAKES	ACREAGE OF LAKES
Argillotrophic	8 (2.6)	50,018 (27.6)
Oligo-Mesotrophic	3 (1.0)	140 (<0.1)
Mesotrophic	36 (11.7)	22,052 (12.2)
Slightly Eutrophic	45 (14.7)	52,069 (28.7)
Fully Eutrophic (Eutrophic)	47 (15.3)	35,634 (19.7)
Very Eutrophic	37 (12.1)	10,818 (6.0)
Low Hypereutrophic	35 (11.4)	1,666 (1.0)
High Hypereutrophic	29 (9.4)	1,253 (0.7)
Dystrophic	0	0
Unknown	67 (21.8)	7,687 (4.1)
Total	307 (100.0)	181,337 (100.0)

Table 11. Trophic State Trends in Lakes (% of total in parentheses)

CATEGORY	NUMBER OF LAKES	ACREAGE OF LAKES
Assessed for Trends	307 (100%)	181,337 (100%)
Improving	7 (2.3%)	7,497 (4.1%)
Stable	84 (27.4%)	123,554 (68.1%)
Degrading	31 (10.1%)	37,383 (20.6%)
Trend Unknown	185 (60.2%)	12,903 (7.2%)

TABLE 12: List of Contaminants Considered in the Assessments

Compliance Monitoring Program

Parameters of Frequent Interest

1,2-dichlorobenzene
1,3-dichlorobenzene
1,4-dichlorobenzene
1,1-dichloroethane
1,2-dichloroethane
1,1-dichloroethylene
1,2-dichloropropane
1,1,2,2-tetrachloroethane
1,1,1-trichloroethane
Aluminum
Ammonia
Antimony
Arsenic
Barium
Benzene
Beryllium
Biochemical Oxygen Demand (BOD)
Boron, total
Bromodichloromethane
Bromoform
Bromomethane
Cadmium
Calcium, total
CBOD
Chloride
Chlorobenzene
Chloroethane
Chloromethane
Chromium, hexavalent
Chromium
Cis 1,3-dichloropropene
Cobalt
Chemical Oxygen Demand (COD)
Cyanide
Dibromochloromethane
Dichloromethane
Dissolved oxygen (DO)
Ethylbenzene
Fecal coliform bacteria (FCB)
Fecal streptococcus bacteria
Fluoride
Hardness, total
Iron
Lead
Magnesium, total
Manganese
MBAS
Mercury
Meta-xylene*
Molybdenum
Nickel
Nitrate + nitrite
Nitrogen, total
Oil and grease
Ortho &/or para-xylene*
Phenols
Phosphorus, total
Potassium, total
Selenium
Silica, total
Silver
Sodium, total
Sulfate
Tetrachloroethylene
Tetrachloromethane
Thallium
Toluene
Total dissolved solids (TDS)
Total suspended solids (TSS)
Trans &/or cis 1,2-dichloroethylene
Trans 1,3-dichloropropene
Trichloroethylene
Trichloromethane
Vanadium
Vinyl chloride
Zinc

Parameters of Occassional Interest (but beyond lab's current analytical capability)

Guanidine nitrate
Nitroguanidine
RDX
TN
Sulfides

*report total zylene

Stream Program

Routine "Inorganic" Parameters
Alkalinity, total
Aluminum
Ammonia
Antimony
Arsenic
Barium
Beryllium
BOD
Boron, total
Bromide
Cadmium
Calcium, total
Chloride
Chromium
Cobalt
Copper
DO
Fluoride
Hardness, total
Iron
Lead
Magnesium, total
Manganese
Mercury
Molybdenum
Nickel
Nitrate
Nitrite
Phosphorus, total
Potassium, total
Selenium
Silica, total
Silver
Sodium, total
Specific conductance
Sulfate
Thallium
TDS
TSS
Turbidity
Vanadium
Zinc

Routine Microbiological Parameters
Fecal coliform bacteria
Fecal streptococcus bacteria

Field Measurement
pH
Temperature

Routine Organic Parameters
2,4-D
2,4,5-T
Acetochlor
Alachlor
Aldrin
Atrazine
Alpha-BHC
Beta-BHC
Delta-BHC
Gamma BHC (Lindane)
Butachlor
Carbofuron (Furadan)
Chlordane
Cyanazine (Bladex)
DCPA (Dacthal)
DDD
DDE
DDT
Deethylatrazine
Deisopropylatrazine
Dieldrin
Endosulfan I
Endosulfan II
Endosulfan Sulfate
Endrin
Heptachlor
Heptachlor epoxide
Hexachlorobenzene
Methoxychlor
Metolachlor (Dual)
Metribuzin (Sencor)
PCB-1016
PCB-1221
PCB-1232
PCB-1242
PCB-1248
PCB-1254
PCB-1260
Picloram
Propachlor (Ramrod)
Propazine (Milogard)
Silvex
Simazine
Toxaphene

Fish Tissue Program - continued

Routine Inorganic Parameters

Cadmium
Lead
Mercury
Selenium

Routine Organic Parameters

1,2,4,5,-Tetrachlorobenzene
p,p'-DDD
p,p'-DDE
p,p'-DDT
Diazinon
Dieldrin
Heptachlor
Heptachlor epoxide
Hexachlorobenzene
gamma-Hexachlorocyclohexane
Mirex
PCB-1248
PCB-1254
PCB-1260
Pentachloroanisole
Perchlorobenzene
Technical Chlordane
    Oxychlordane
    cis-Chlordane
    trans-Chlordane
    cis-Nonachlor
    trans-Nonachlor
Trifluralin (Treflan)

Lake Program

Routine "Inorganic" Parameters

Alkalinity, total
Aluminum
Ammonia
Antimony
Arsenic
Barium
Beryllium
Boron
Bromide
Cadmium
Calcium
Chloride
Chromium
Cobalt
Copper
Fluoride
Hardness, total
Iron
Kjeldahl nitrogen
Lead
Magnesium
Manganese
Mercury
Molybdenum
Nickel
Nitrate
Nitrite
Ortho-phosphate
pH
Phosphorus, total
Potassium
Selenium
Silica
Silver
Sodium
Specific conductance
Sulfate
Thallium
Total dissolved solids
Total suspended solids
Turbidity
Vanadium
Zinc

Routine Microbiological Parameters

Fecal coliform bacteria

Fecal streptococcus bacteria

Routine Organic Parameters

2,4-D
2,4,5-T
Acetochlor
Alachlor
Aldrin
Atrazine
Butachlor
Carbofuran
Chlordane
Cyanazine
DCPA (Dacthal)
p,p’-DDD
p,p’-DDE
p,p’-DDT
Dieldrin
Endosulfan I & II
Endosulfan sulfate
Endrin
Alpha BHC
Beta BHC
Gamma BHC (Lindane)
Delta BHC
Heptachlor
Heptachlor epoxide
Hexachlorobenzene
Methoxychlor
Metolachlor
Metribuzin
PCB-1016
PCB-1221
PCB-1232
PCB-1242
PCB-1248
PCB-1254
PCB-1260
Picloram
Propachlor
Propazine

Lake Program - continued

Routine Organic Parameters (continued)

Silvex (2,4,5-TP)
Toxaphene

Miscellaneous

Algal taxonomy*
Chlorophyll-a
Dissolved oxygen
Macrophyte abundance*
Secchi depth*
Temperature

* not chemical analyses

Occasional Parameters (special projects)

Biological oxygen demand
Chemical oxygen demand
Deethylatrazine
Deisopropylatrazine
Zooplankton taxonomy*

* not chemical analyses

Groundwater Program

Routine Physical Properties

Temperature

Routine "Inorganic" Parameters

Alkalinity (as $CaCO_3$)
Aluminum
Ammonia (as N)
Antimony
Arsenic
Barium
Beryllium
Boron, total
Bromide
Cadmium
Calcium, total
Chloride
Chromium
Cobalt
Copper
Fluoride
Hardness, total
Iron
Lead
Magnesium, total
Manganese
Mercury
Molybdenum
Nickel
Nitrate (as N)
Nitrite (as N)
Ortho Phosphate (as P)
pH
Phosphorus, total (as P)
Potassium, total
Selenium
Silica, total
Silver
Sodium, total
Specific conductance
Sulfate
Thallium
TDS
Vanadium
Zinc

Routine Organic Parameters

2,4-D
2,4,5-T
Acetochlor
Alachlor
Aldrin
Atrazine
alpha-BHC
beta-BHC
delta-BHC
Bladex (Cyanazine)
Butachlor
Carbofuran (Furadan)
Chlordane
DCPA (Dacthal)
Dieldrin
Endrin
Endosulfan I
Endosulfan II
Endosulfan Sulfate
Heptachlor
Heptachlor epoxide
Hexachlorobenzene
Lindane (Gamma BHC)
Methoxychlor
Metolachlor
PCB-1016
PCB-1221
PCB-1232
PCB-1242
PCB-1248
PCB-1254
PCB-1260
p,p’-DDD
p,p’-DDE
p,p’-DDT
Propazine
Ramrod (Propachlor)
Sencor (Metribuzin)
Silvex
Simazine
Tordon (Picloram)
Toxaphene

Groundwater Program - continued

Routine Purgable Organic Parameters

1,2-dichlorobenzene
1,3-dichlorobenzene
1,4-dichlorobenzene
1,1-dichloroethane
1,2-dichloroethane
1,1-dichloroethylene
1,2-dichloropropane
1,1,2,2-tetrachloroethane
1,1,1-trichloroethane
1,1,2-trichloroethane
Benzene
Bromodichloromethane
Bromoform
Bromomethane
Chlorobenzene
Chloroethane
Chloromethane
Cis 1,3-dichloropropene
Cis 1,2-dichloroethylene
Dibromochloromethane
Dichloromethane
Ethylbenzene
Tetrachloroethylene
Tetrachloromethane
Toluene
Trans 1,3-dichloropropene
Trans 1,2-dichloroethylene
Trichloroethylene
Trichloromethane
Vinyl chloride
Xylene

Routine Radiological Parameters

Gross alpha
Gross Uranium
Radium-226
Radium-228
Radon-222
Total dissoved solids

Table 13. Summary of Domestic Water Supply Use Impairments in Streams

Total Stream Mileage Designated for Use: 8,612 **Total Stream Mileage Assessed for Use:** 6,825			
	Miles	**Percent**	**Major Causes**
Fully Supporting Use	4,038	59	
Fully Supporting Use but Threatened	*	*	
Partially Supporting Use	244	4	
Not Supporting Use	2,543	37	sulfate chloride fluoride
Total Assessed for Use	6,825	100	

* not applicable

Table 14. Summary of Domestic Water Supply Use Impairments in Lakes

Total Waterbody Area Designated For Use: 148,360 acres **Total Waterbody Area Assessed For Use: 181,337 acres**			
	Acres	**Percent**	**Major Causes**
Fully Supporting Use	0 (0)	0 (0)	
Fully Supporting Use but Threatened	81,245 (85,326)	55 (47)	
Partially Supporting Use	47,367 (58,094)	32 (32)	eutrophication sulfate chloride
Not Supporting Use	19,748 (37,917)	13 (21)	eutrophication atrazine sulfate chloride
Total Assessed For Use	148,360 (181,337)	100 (100)	

PART IV: GROUNDWATER

A statewide EPA approved Wellhead Protection Program (WHPP) is now fully established and is rapidly gaining momentum. A number of Kansas counties and communities are in the process of developing local WHPP plans. The City of Hays has implemented a local WHPP.

There are no other significant changes since the December 1996 305(b) Report. Summary tables, although not required, have been provided as follows:

Table 15. Groundwater Contamination Summary
Table 16. Aquifer Monitoring Data

Table 15. Groundwater Contamination Summary. Statewide Cumulative Summary Through December 31, 1997

Source Type	# of Kansas Sites	# of Sites with Confirmed Releases	# with Confirmed Groundwater Contamination	Primary Contaminants	# of Site Assess-ments	# of Sites with Source Removed	# of Sites with CAPs	# of Sites with Active Remediation	# of Sites with Cleanup Resolved
NPL	15	15	13	VOCs, metals	15	unavailable	1	5	3
CERCLIS (non-NPL)	700	700	456	VOCs, metals & pesticides	700	unavailable	26	154	159
DOD/DOE	50	50	22	VOCs, metals	50	unavailable	2	6	2
LUST	8,000	3,900	unavailable	petroleum	8,000	3,500	unavailable	1,700	1,900
RCRA Corrective Action	under EPA control								
Underground Injection *	40	0	0	none	0	0	0	0	0
State Sites **	650	650	434	VOCs, metals	650	unavailable	24	148	157
NPS	unknown								

CAPs - Corrective Action Plans
CERCLIS - Comprehensive Environmental Response, Compensation, and Liability Information System
DOD/DOE - Department of Defense/Department of Energy
LUST - Leaking Underground Storage Tanks
NPL - National Priority List
NPS - Non Point Source
RCRA - Resource Conservation and Recovery Act
* Represents Class I and III injection wells and hydrocarbon storage sites, but does not include Class II brine injection wells.
** Numbers do not include sites under KCC jurisdiction or LUST sites.

Table 16. Aquifer Monitoring Data
Statewide summary for the period of 1996-1997

Monitoring Data Type	Total # of Well Samples in the Assessment	Parameter Groups	Parameters Not Detected or Nitrate ≤5 mg/L	Parameters Detected or Nitrate >5 to ≤10 mg/L	Parameters Exceeding the MCLs	Removed From Service	Special Treat-ment	Background Parameters Exceeding MCLs
Ambient	43	VOCs	24	19	0			
Groundwater	267	Pesticides	247	20	0			
Quality	267	Nitrate	162	78	27			
Monitoring	267	Fluoride	7	259	1			1
Network	267	Selenium	84	181	2			2
	39	Radio-nuclides	1	35	3			3

NOTES: (1) Some wells were sampled more than once during the reporting period (1996-1997).
(2) All data obtained from the groundwater monitoring network only.
(3) Only parameters with federal drinking water MCLs were included in this summary.
(4) Some of the contaminated wells are presently used for monitoring purposes only.
(5) Groundwater monitoring network samples were collected after well purging and prior to treatment.

Table 16 - continued. Aquifer Monitoring Data
Statewide summary for the period of 1996-1997

Monitoring Data Type	Total # of Well Samples in the Assessment	Parameter Groups	Parameters Not Detected or Nitrate ≤5 mg/L	Parameters Detected or Nitrate >5 to ≤10 mg/L	Parameters Exceeding the MCLs	Removed From Service	Special Treat-ment	Background Parameters Exceeding MCLs
Finished Water	984	VOCs	930	45	9			
Quality Data	193	SOCs	91	95	7			
From Public	3,057	Nitrate	1,909	864	284			
Water Supply	1,067	Fluoride	24	1,039	4			
Wells	1,062	Mercury	1,039	17	6			
	1,107	Selenium	119	942	46			
	984	Ethylene Dibromide	939	39	6			

NOTES: (1) Some wells were sampled more than once during the reporting period (1996-1997).
(2) All data obtained from compliance monitoring of public water supply systems.
(3) Only parameters with federal drinking water MCLs were included in this summary.
(4) Does not include data analyzed by private laboratories (this data is not yet computerized).
(5) Does not include SOC data analyzed using the immunoassay method.
(6) SOC data does not include Ethylene Dibromide data (listed separately).
(7) An individual sample that exceeded a MCL does not necessarily mean that the entire PWS system was out of compliance.

APPENDIX A

STATE OF KANSAS SECTION 106 MONITORING STRATEGY

The Kansas Department of Health and Environment and its predecessor agency, the Kansas State Board of Health, have together monitored the quality of the state's surface water and groundwater resources for over a century. Data obtained through these efforts have supported a number of important regulatory initiatives, including the identification and prioritization of water pollution problems, the evaluation and refining of water pollution control efforts and remedial actions, and the establishment of appropriate limits on the kinds and amounts of contaminants released into the aquatic environment. Demands placed upon the state's surface water and groundwater resources by an expanding human population and a rapidly growing economy underscore the need for an efficient and comprehensive monitoring strategy, both now and in the years to come.

This document presents the water quality monitoring strategy currently employed by the Kansas Department of Health and Environment. It is divided into two sections. The first presents a general overview of the department's five major water quality monitoring programs. The second provides a more detailed, technical description of these programs and discusses the measures taken by the department to ensure the overall integrity of the monitoring data. This monitoring strategy is currently being updated by the department as part of a comprehensive revision of the Kansas Continuing Planning Process (CPP).

SECTION I : Description of Ambient Water Quality Monitoring Programs

The department maintains five primary water quality monitoring programs. These address (1) the physicochemical properties and general sanitary condition of streams and rivers, (2) the biological properties of streams and rivers, with emphasis on the composition of aquatic and semiaquatic macroinvertebrate communities, (3) the physicochemical and biological properties of lakes and wetlands, (4) contaminant concentrations in the tissues of bottom-feeding fish, and (5) the physicochemical properties of groundwater utilized for municipal, agricultural, industrial and other consumptive purposes. These monitoring programs play an important role in the department's efforts to identify water pollution problems within the state and to comply with the water quality reporting requirements of the Clean Water Act and 40 CFR 130.8. A general description of each of these major programs is provided below.

Stream Chemistry Monitoring Program

Prior to 1972, the protection of public drinking water supplies provided the principal impetus for stream monitoring activities in Kansas. During the late 1970s and early 1980s, monitoring activities were geared more toward the evaluation of the effects of major reservoirs on downstream physicochemical conditions, toward the quantification of contaminant levels in streams entering and exiting Kansas, and toward the determination of the effects of municipal and industrial wastewater discharges on the functional integrity of stream ecosystems. A comprehensive review of the stream chemistry monitoring network was completed prior to the 1990 sampling year, focusing on the network's ability to discern the water quality impacts of

nonpoint source (NPS) pollution. This review revealed two primary inadequacies from an NPS perspective. First, western Kansas was poorly represented in the network in terms of the spatial distribution and number of stream monitoring stations. Second, few sampling stations were located on lower order tributaries, even though the water quality impacts of NPSs were likely to be most clearly manifested in such tributaries. To enhance the monitoring program's overall effectiveness in identifying NPS pollution problems, it was determined that more streams in western Kansas and more lower order streams throughout the state should be included in the sampling network.

The ambient stream chemistry network was expanded in 1990 to address these two concerns. The revamping of the network resulted in a 130% increase in the number of monitoring sites (from 115 to 265) and in a more equitable representation of all major physiographic, geological, and land use regions within the state. Grab samples are now collected from stations on a bimonthly basis and analyzed for a wide assortment of conventional pollutants, heavy metals, pesticides, and other parameters. Monitoring station selection criteria, sample collection, preservation, transport and analysis methods, and quality assurance (QA) and quality control (QC) requirements for this program are described in Section II. In addition to day-to-day QA/QC practices, periodic audits are conducted to assess the performance of program staff and to independently determine the representativeness, precision and accuracy of the monitoring data.

The stream chemistry monitoring program endeavors to provide timely and scientifically defensible information on the physical, chemical, and bacteriological quality of flowing waters in Kansas. This information is specifically intended for use in:

1. complying with the water quality monitoring and reporting requirements of 40 CFR 130.4 and sections 106(e)(1), 303(d), and 305(b) of the federal CWA;

2. evaluating waterbody compliance with the provisions of the Kansas surface water quality standards (K.A.R. 28-16-28b *et seq*.);

3. identifying point sources and NPSs contributing most significantly to documented water use impairments;

4. documenting spatial and temporal trends in surface water quality resulting from changes in land use patterns, resource management practices, and/or climatological conditions;

5. developing scientifically defensible environmental standards, wastewater treatment plant (WWTF) permits, waterbody/watershed pollution control plans, and total maximum daily loads (TMDLs); and

6. evaluating the effectiveness of pollution control efforts and waterbody remediation/restoration initiatives implemented by the department and other natural resource agencies and organizations.

All field and laboratory data generated from stream water quality samples are handled in an orderly and consistent manner. Time and date of sample collection, stream monitoring station identification number, and other basic information are recorded on standardized sample submission forms and submitted through a chain-of-custody procedure along with the water

quality samples to the Kansas Health and Environmental Laboratories (KHEL). Upon completion of the laboratory analyses, the KHEL computer automatically downloads the data to the Kansas Water Database, which is accessed through the KDHE IBM AS-400 computer system. Hard copies of all physicochemical and bacteriological data generated by KHEL are maintained by KDHE's Bureau of Environmental Field Services (BEFS). These data are carefully reviewed for obvious errors or omissions. Information derived from the QC samples (duplicates, spikes, blanks, etc.) are subjected to a particularly thorough review. With the approval of the section chief, data that are deemed inaccurate or grossly unrepresentative are purged from the electronic database. Laboratory data are electronically downloaded onto the EPA STORET database on a monthly basis. Field data are similarly loaded onto electronic spreadsheets, checked for obvious errors or omissions, and downloaded onto STORET each month. Redundant forms of data storage and backup files (EPA STORET system, Kansas Water Database, KHEL tape files, BEFS hard copy files) help to ensure the long-term integrity and availability of the program data.

Biological Monitoring Program

Freshwater macroinvertebrate communities, consisting of insects, crustaceans, mollusks, annelids and other organisms which lack a true backbone and are observable with the unaided eye, have long been recognized as excellent indicators of water quality. Ongoing pollution problems, whether continuous or intermittent in nature, tend to reduce in abundance the more pollution intolerant macroinvertebrate species. Conversely, tolerant forms often achieve unusually high densities due to reduced interspecific competition for food, elimination of predators, or other factors. The predictable community-level response to environmental pollution is, therefore, a measurable reduction in macroinvertebrate species richness and an increase in the abundance of tolerant taxa. Where macroinvertebrate sampling efforts are used in conjunction with physicochemical monitoring activities, the ability to detect ongoing water quality problems is greatly enhanced, even at low biological sampling frequencies.

The stream biological monitoring program was initiated by the Kansas Department of Health (later reorganized into KDHE) in April 1972. The original monitoring network included 33 stream stations, located at widely scattered locations across the state. Initial goals of the program were to document long-term trends in surface water quality and to supplement site-specific information then being gathered through other departmental monitoring efforts. During the first six years of the program, field protocols entailed a combination of qualitative and quantitative sampling techniques at all stream monitoring stations. Qualitative methods included the collection of macroinvertebrate specimens from all accessible microhabitats using D-frame nets and other simple apparatus. Quantitative methods, focusing on the density of macroinvertebrate populations, varied depending on the predominant substrate type. A Surber sampler generally was used on coarse sediments such as cobble and gravel, whereas a petite Ponar dredge was used on finer sediments such as sand and silt. These tools were not well suited to the sampling of woody debris, tree roots, emergent aquatic vegetation, or other nonhomogeneous surfaces, even though such habitats accounted for much of the macroinvertebrate abundance and diversity in many Kansas streams. Hence, early quantitative measures of macroinvertebrate abundance and diversity employed by the agency tended to underestimate the actual size and complexity of stream biological communities.

In 1978, the monitoring program adopted a revised protocol for the collection of macroinvertebrate samples. This new protocol was "semi-quantitative" in nature, in that it measured the number of specimens collected in a prescribed (one-hour) time frame but involved the use of D-frame nets and other tools previously associated with qualitative sampling activities.

Emphasis on the number and kinds of specimens collected per unit time (rather than on aerial or volumetric estimates of macroinvertebrate density predicated on the use of Surber samplers and Ponar dredges) permitted the examination of essentially all types of stream habitat. The revised protocol proved to be less resource intensive and produced a more consistent measure of macroinvertebrate abundance and diversity. Similar protocols were eventually endorsed by EPA and applied within the water quality assessment programs of several other states (see Rapid Bioassessment Protocol III in Plafkin *et al*. 1989).

From 1984 onward, monitoring activities at all stations adhered to a seasonal rotational schedule to reduce statistical bias and to provide a more comprehensive picture of the resident biological communities; i.e., samples were collected during the spring of one year, the summer of the next, and the fall of the next, a cycle which was repeated every three years. Although macroinvertebrate sampling activities at many of the original monitoring stations were eventually discontinued, new sites were continually added to the network and, over time, the total number of active stations increased. Macroinvertebrate communities were surveyed at 50 monitoring stations during the period 1995-1996, and 44 stations were sampled in 1996 alone. As of January 1997, a total of 89 stations had been sampled for a duration of at least three consecutive years, and 36 of these stations, known as "core" sites, had been sampled for a period of 10-16 consecutive years. A detailed description of the sampling and taxonomic methods and QA/QC practices currently employed in the program is provided in the program QA management plan and accompanying standard operating procedures (Section II).

Fish Tissue Monitoring Programs

Kansas continues to monitor the impact of toxic substances on surface water quality through the analysis of contaminants in fish tissue (Section II). A combination of fixed and rotating stations is used in this program to evaluate environmental trends, aquatic life support, and the human health significance of contaminants in fish. The program consists of the following subcomponents: (1) Regional Ambient Fish Tissue Monitoring Program (RAFTMP); (2) the Kansas Follow-up Studies Program (KFSP); and (3) the KDHE Fish Tissue Intensive Survey Program (FISP). Fish tissue monitoring activities are conducted at as many as four RAFTMP sites and 16 KFSP and FISP sites each year.

Regional Ambient Fish Tissue Monitoring Program: The RAFTM program is an environmental monitoring program implemented in 1980 by EPA Region VII and administered in Kansas by KDHE. Analysis of fish tissue samples is conducted by the Region VII Environmental Services Laboratory. This program endeavors to (1) monitor long-term trends in fish tissue contaminants at selected fixed stations; (2) monitor levels of fish tissue contaminants for environmental significance; and (3) screen waterbodies of the state for levels of fish tissue contaminants of potential human health concern. The target species of RAFTMP is the common carp, *Cyprinus carpio*, because of its ubiquitous and abundant nature in Kansas waters and its bottom-feeding behavior. Analyses are conducted on composite samples of three to six whole-fish to improve the representativeness of the data. In 1994, the Region VII Environmental Services Laboratory reduced RAFTMP sample allocation by 75 percent.

Kansas Follow-up Studies Program: Implemented at its present scale in 1986, KFSP is a program whereby EPA, under provisions of the Kansas 604(b) work plan, provides additional laboratory capacity to KDHE for edible portion fish tissue analyses. The major goals of KFSP include (1) evaluation of human health significance of edible-portion (fillet) fish tissue contaminants at sites where RAFTMP whole-fish samples have indicated elevated levels of

contaminants and (2) evaluation of the human health significance of contaminants in edible fish tissues at localities where the probability of contamination is high and where historical data are lacking (or where additional information is needed to direct more intensive surveys of local fish tissue quality). Frequently the common carp is used for this assessment; however, if more commonly eaten catfish species of appropriate size are available, then specimens of such species are preferentially collected and analyzed. Bottom-feeding fish species are preferred because they generally represent the worst case contamination scenario. Duplicate composite samples are routinely collected and analyzed.

KDHE Fish Tissue Intensive Survey Program: The fish tissue monitoring and survey program, FISP, was implemented in 1986. This program endeavors to (1) define water body segments where resident fish contain high body burdens of the insecticide chlordane for the purpose of delineating segments requiring consumption advisories or warnings, (2) provide long-term monitoring of waterbody segments with current or past fish consumption advisories or warnings, and (3) confirm findings of the EPA Region VII Environmental Services Laboratory in cases where preliminary (RAFTMP/KFSP) data indicate that levels of fish tissue contamination may pose human health concerns. Analyses of fish tissue samples for technical chlordane are conducted by KDHE's Health and Environmental Laboratory.

Lake and Wetland Water Quality Monitoring Program

Lake and wetland monitoring activities conducted by KDHE have significantly changed since the inception of the program in 1975. The monitoring network originally consisted of eight to ten intensively surveyed lakes. In 1985, a statistical evaluation of the lake database indicated that the department's informational needs were better met by reducing the amount of work at specific waterbodies in favor of expanding geographic coverage of the state. During 1988-1992, the network was further adjusted to include state managed wetland areas (1988) and to collect data on the abundance of macrophytic vegetation in lakes (1991). Since 1993, the network has consisted of approximately 120-130 monitored sites, with representative lakes in all major river basins and physiographic regions.

Lakes/wetlands are sampled by the department on a 3-5 year cycle for nutrients, metals, minerals, pesticides, water clarity, dissolved oxygen, temperature, algal abundance, and bacterial quality. Lake/wetland selection criteria, sample collection, preservation, transport and analysis methods, and QA/QC requirements for this program are described in a detailed program management plan and accompanying set of standard operating procedures. In addition to day-to-day QA/QC practices, periodic audits are conducted to independently determine the representativeness, precision and accuracy of the monitoring data (Section II).

Groundwater Quality Monitoring Program

The Kansas groundwater quality monitoring network was established in 1976 as a cooperative program between USGS and KDHE. KDHE assumed sole responsibility for this program in 1990. Since that time, the program has endeavored to procure data suitable for identifying temporal and spatial trends in groundwater quality associated with alterations in land use, the implementation of NPS best management practices, changes in groundwater availability or withdrawal rates, and shifts in climatological conditions. In addition, the network is intended to assist in the identification of groundwater contamination problems. Currently, the Kansas groundwater quality monitoring network is composed of 242 wells used for public or private (domestic) water supply, irrigation, livestock watering, and/or industrial purposes. During the

period 1996-1997, 267 well samples were analyzed for common inorganic chemicals and heavy metals; 267 well samples were analyzed for pesticides; 43 well samples were analyzed for volatile organic compounds (VOCs); and 39 well samples were analyzed for radionuclides (Section II). Network wells are sampled for inorganic parameters on each sampling occasion. Wells sampled for pesticides, VOCs, and radionuclides are rotated systematically throughout the network. Five wells in southeastern Kansas are repeatedly sampled for selected radioactive constituents, owing to known contamination problems in that region of the state.

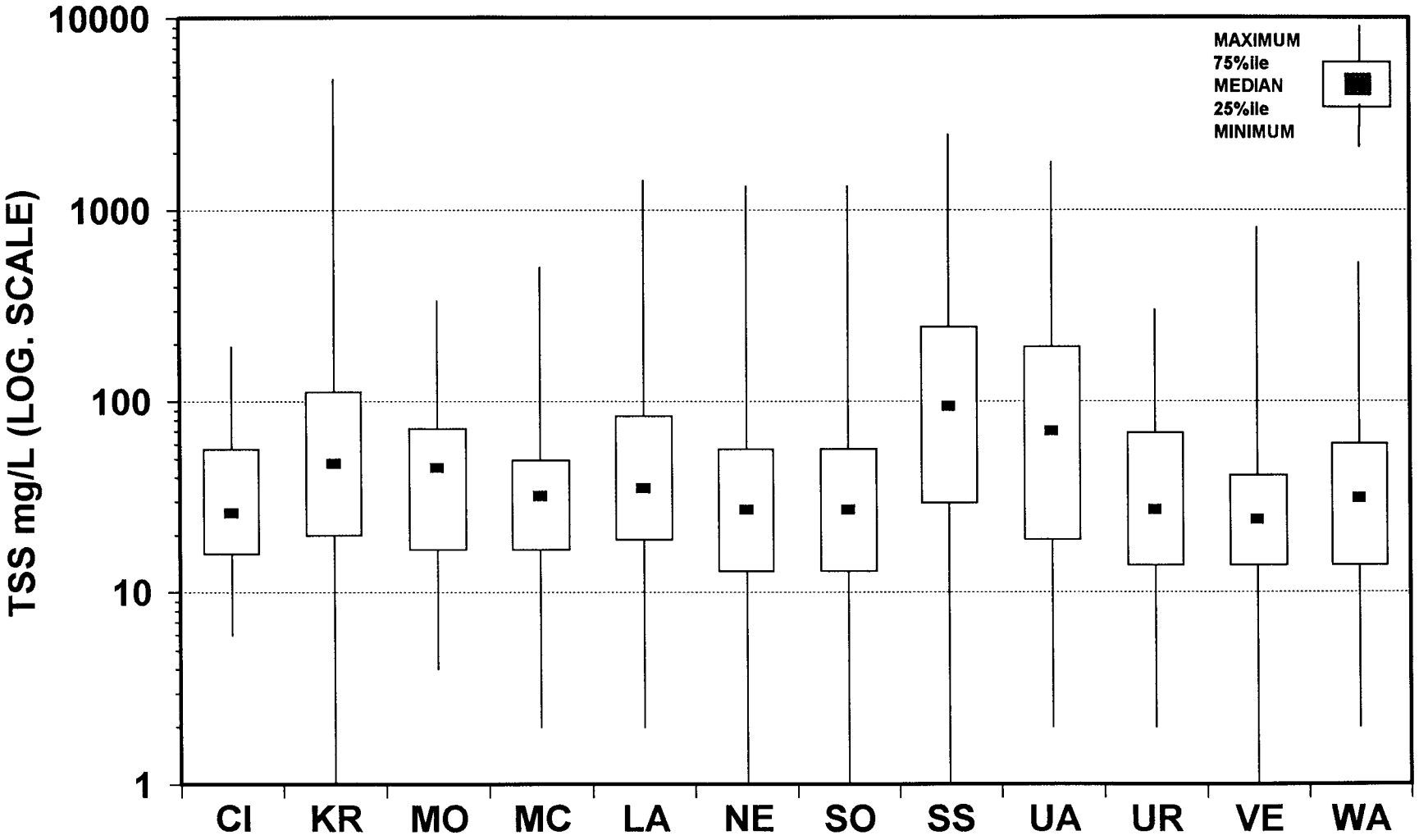
Section II: Monitoring Program Quality Assurance Management Plans

This section compiles all program-level QA management plans dealing with the assessment of surface water and groundwater quality. Owing to this section's large size (255 pages), it has been omitted from copies of the 305(b) report distributed to the general public. Interested individuals may obtain this documentation by writing or visiting the address provided on the cover of this 305(b) report or by contacting Ricquelle Landis, Bureau of Environmental Field Services, at 785-296-6603.

APPENDIX B

TSS CONCENTRATIONS IN KANSAS BASINS

1996-1997



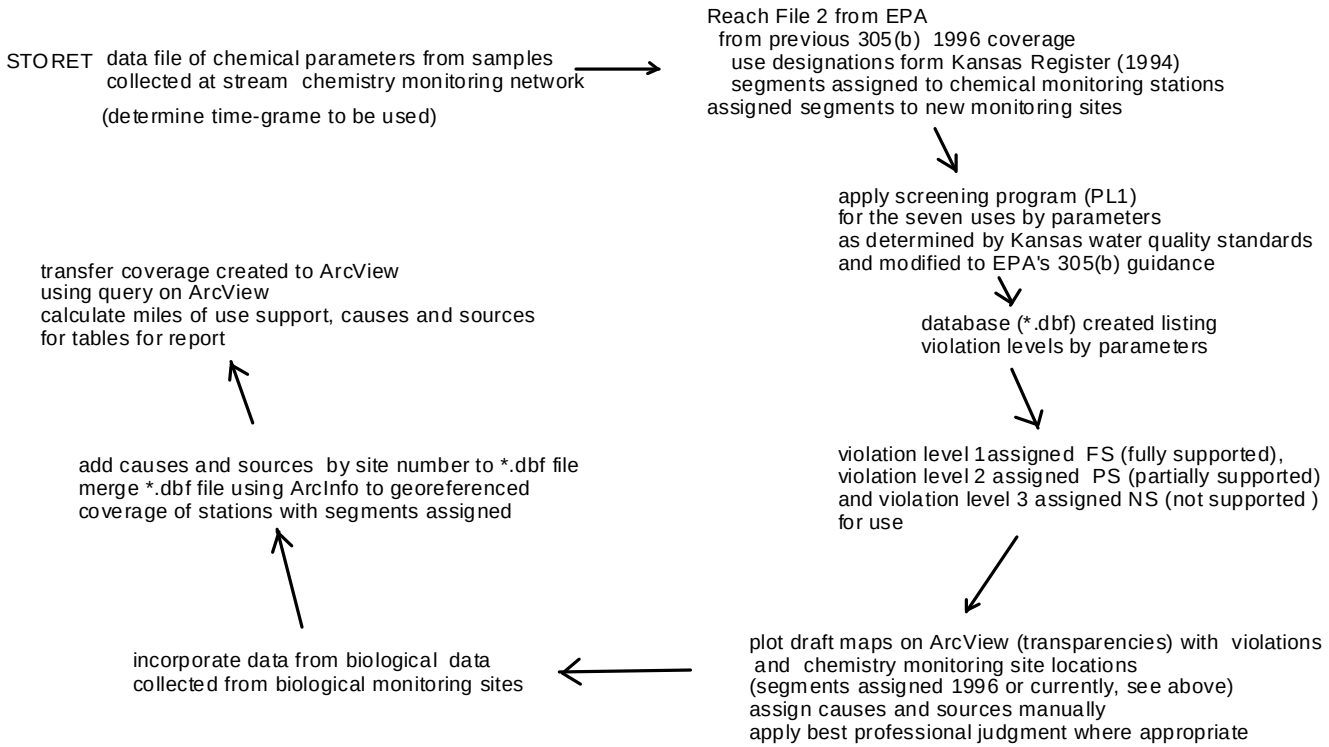
CI=CIMARRON
LA=LOWER ARKANSAS
UA=UPPER ARKANSAS

KR=KANSAS/LOWER REPUBLICAN
NE=NEOSHO
UR=UPPER REPUBLICAN

MO=MISSOURI
SO=SOLOMON
VE=VERDIGRIS

MC=MARAIS DES CYGNES
SS=SMOKY HILL/SALINE
WA=WALNUT

APPENDIX C
STREAM ASSESSMENT PROTOCOL



APPENDIX D

Clean Lakes and Wetlands

Summary Statistics

Table 1 presents a comparison of lake acreage investigated during the 1993-1997 reporting cycle through the use of biological/habitat metrics, physicochemical measurements, or both biological/habitat metrics and physicochemical measurements. Note that assessment activities at all monitored and evaluated lakes incorporated both of these assessment approaches. Table 16 differs from previous reports in that only aquatic life use exceedences for acute criteria were used in generating the numbers. Inclusion of chronic criteria produces numbers similar to previous 305(b) reports. Table 2 lists the number of public lakes, and associated surface acreage, impacted by identifiable point and NPSs of pollution.

Table 1. Categories of Data used in ALUS Assessments for Lakes

DEGREE OF ALUS (acute criteria only)	ACRES ASSESSED BASED ON BIOLOGICAL HABITAT DATA ONLY	ACRES ASSESSED BASED ON PHYSICAL/ CHEMICAL DATA ONLY	ACRES ASSESSED BASED ON/ BIOLOGICAL/ CHEMICAL DATA	TOTAL ACRES ASSESSED FOR ALUS
Fully supported	0	0	0	0
Fully supported but threatened	0	0	92,951	92,951
Partially supported	0	0	85,137	85,137
Not supported	0	0	3,249	3,249

Table 2. Lake Acreage With Identifiable Point and Nonpoint Source Pollution Contributions

POLLUTION TYPE	NUMBER OF LAKES*	ACRES OF LAKES
Point Sources	25	140,680
Nonpoint Sources	251	169,736
No Identifiable Pollution Sources	56	11,601

*Numbers include any level of point source inputs, and any magnitude or combination of NPSs. Due to the fact that a number of lakes have both source types within their watersheds, the numbers will not necessarily total to the acres/numbers of lakes reported in this chapter.

Clean Lakes Program

Background

A total of 307 publicly owned or publicly accessible lakes are included in this reporting cycle. These lakes comprise 181,337 surface acres. Other background data are similar to the 1996 305(b) report.

Trophic Status

Trophic state classification in lakes and wetlands is based primarily on the observed chlorophyll-a level (corrected for phaeophytin-a.) The observed level of chlorophyll provides an estimate of overall lake productivity. In addition, higher levels of algal biomass produce correspondingly lower aesthetic appeal and general recreational opportunities, increased problems and cost in treatment of drinking water, and increased problems with using water for livestock and irrigation. Because of this, and the "multi-parameter" characteristics of the metric, the trophic state estimate also becomes valuable for assessing overall use support of lakes. Lake trophic state, for Kansas lakes, is viewed as a valuable biological metric for assessment and is in keeping with the increased emphasis on biological criteria for water quality.

While high levels of sedimentation are often concurrent with the eutrophication process, current KDHE monitoring does not allow more than a rough indication of sedimentation problems. When sedimentation problems are visually obvious, they are utilized in "weighting" assigned trophic state classifications.

Chlorophyll-a values are converted to Trophic State Index (TSI) values using the formula in Carlson (1977). These TSI numbers are then used to assign a trophic state classification based on the following scale for lakes in the KDHE Lake and Wetland Monitoring Program:

Argillotrophic = TSI <40 but turbidity/nutrient levels chronically high,
Oligo-Mesotrophic = TSI of <40,
Mesotrophic = TSI of 40 to 49.99,
Eutrophic = TSI of 50 to 63.99,
- Slightly Eutrophic = TSI of 50 to 54.99,
- Fully Eutrophic = TSI of 55 to 59.99,
- Very Eutrophic = TSI of 60 to 63.99,

Hypereutrophic = TSI of >= 64,
- Low Hypereutrophic = TSI of 64 to 69.99,
- High Hypereutrophic = TSI of >=70.

While some Kansas lakes have a significant amount of overall lake productivity in the form of macrophyte biomass, the trophic state classifications in this 305(b) report are based entirely on phytoplanktonic productivity and biomass. Macrophyte abundance, as a potential impairment for lake uses, will be addressed separately. Table 3 presents trophic state ratings for the lakes assessed during this reporting cycle.

Table 3. Trophic Status of Lakes Assessed During This Reporting Cycle (Percent of total in parentheses)

TROPHIC STATUS	NUMBER OF LAKES	ACREAGE OF LAKES
Argillotrophic	8 (2.6)	50,018 (27.6)
Oligo-Mesotrophic	3 (1.0)	140 (<0.1)
Mesotrophic	36 (11.7)	22,052 (12.2)
Slightly Eutrophic	45 (14.7)	52,069 (28.7)
Fully Eutrophic (Eutrophic)	47 (15.3)	35,634 (19.7)
Very Eutrophic	37 (12.1)	10,818 (6.0)
Low Hypereutrophic	35 (11.4)	1,666 (1.0)
High Hypereutrophic	29 (9.4)	1,253 (0.7)
Dystrophic	0	0
Unknown	67 (21.8)	7,687 (4.1)
Total	307 (100.0)	181,337 (100.0)

Control Methods

No changes from the 1996 305(b) report.

Restoration/Rehabilitation Efforts

No changes from the 1996 305(b) report, except that all Clean Lakes Program projects are now completed.

Impaired and Threatened Lakes

Table 4 summarizes overall use support ratings for lakes assessed during this reporting cycle. Impairments related to chronic aquatic life support criteria were not included in the analysis. Support rating for individual designated uses for lakes is presented in Table 5.

All monitored lakes have data for a range of heavy metals and pesticides, including a number of those substances defined as “toxics” by the EPA. Out of the total reported acreage (181,337 acres) 169,714 acres are surveyed for total recoverable metals and pesticides (93.6% of the total). For the purposes of this report, due to EPA promulgated dissolved metals criteria, the majority of KDHE metals data have not been used for use support analysis. Of the total acres assessed for toxics, 18,199 acres (10% of total) demonstrated some level of impairment or exceedence due to metals or pesticides. Table 6 shows assessment data pertaining to the causes of use impairments in lakes in Kansas while Table 7 lists contaminant sources responsible for lake use impairments.

Table 4. Summary of Fully Supporting, Threatened, and Impaired Lakes

DEGREE OF USE SUPPORT	ASSESSMENT CATEGORY		TOTAL ASSESSED ACRES
	EVALUATED	MONITORED	
Fully supporting all uses	0	0	0
Supporting but threatened for at least one use	8,136	52,821	60,957
Size impaired for one or more uses	3,487	116,893	120,380
Total size assessed	11,623	169,714	181,337

Acid Effects on Lakes

No significant changes from the 1996 305(b) report.

Trends in Lake Water Quality

Time trends in lake water quality are difficult to determine, given that the chemical data do not lend themselves well to statistical analysis at this time. Trophic state remains the indicator of overall lake water quality for the determination of trends within this report. If a given lake had trophic state assessments for three, or more, occasions during the last twelve years, then a trend of "improving," "degrading," or "stable" was assigned. If no recent trophic state data were available, or if the most recent data were more than eight years old, then a trend classification of "unknown" was assigned. Table 8 presents the lake trophic state trends for this reporting period.

According to the data in Table 8, the majority of lakes are of unknown trophic state trend, but they constitute less than eight percent of the total reported acreage. These are the small lakes that have undergone assessment, but have not been monitored for trophic state over time. Therefore, trends cannot be determined. Of the monitored lake acreage in Kansas, almost 70% is stable over time, while slightly more than 20% appear to be degrading over time. Very few lakes in the state have shown any appreciable improvement in trophic state condition during this reporting cycle.

Table 5. Individual Use Summary in Acres for Lakes

GOALS	USE	SIZE ASSESSED	SIZE FULLY SUPPORTING BUT THREATENED	SIZE PARTIALLY SUPPORTING	SIZE NOT SUPPORTING	SIZE NOT ATTAINABLE
Protect & Enhance Ecosystems	Aquatic Life (acute criteria only)	181,337	92,951	85,137	3,249	0
Protect & Enhance Public Health	Fish Consumption	45,107	45,106	0	1	0
	Shellfishing	*	*	*	*	*
	Swimming	181,337	88,630	88,362	4,345	0
	Secondary Contact	181,337	166,728	11,724	2,885	0
	Domestic Water Supply	181,337	85,326	58,094	37,917	-
Social & Economic Enhancement	Agricultural (irrigation)	181,337	164,756	11,434	5,147	-
	Agricultural (livestock)	181,337	167,052	11,534	2,751	-
	Cultural	*	*	*	*	*

* = category not applicable

0 = category applicable, but size of waters in category is zero

\- = category applicable, no data available

Table 6. Total Lake Acres Impacted by Various Cause Categories

CAUSE CATEGORY	ACRES BY CONTRIBUTION TO IMPAIRMENT	
	MAJOR	MODERATE/MINOR
Cause unknown	0	0
Unknown toxicity	-	-
Pesticides	16,019	6,191
Priority organics	-	-
Nonpriority organics	-	-
Metals	349	245
Ammonia	-	-
Chlorine	-	-
Other inorganics (fluoride)	11	115
Nutrients/eutrophication	21,818	142,748
pH	50	16,043
Siltation	*	*
Organic enrichment/low DO	7	9,429
Salinity/TDS/chlorides	9,191	9,008
Thermal modifications	-	-
Flow alterations	396	11,332
Other habitat alterations	-	-
Pathogen indicators	370	208
Radiation	-	-
Oil and grease	-	-
Taste and odor**	20,566	?**
Suspended solids	50,118	1,045
Noxious aquatic plants	527	2,065
Total toxics	-	-
Turbidity	50,118	1,045
Exotic species	-	-
Other (specify)	-	-

- = Category applicable, no data available.
* = Statewide problem, no direct measurements available
** = Reflects problems severe enough to request KDHE assistance. Other incidents are unreported.

Table 7. Total Lake Acres Impaired by Various Source Categories

SOURCE CATEGORY	CONTRIBUTION TO IMPAIRMENT	
	MAJOR	MODERATE/MINOR
Industrial Point Sources	-	-
Municipal Point Sources	30,180	110,500
Combined Sewer Overflows	-	-
Agriculture	38,199	118,931
Silviculture	-	-
Construction	-	-
Urban Runoff/Storm Sewers	361	7,214
Resource Extraction	1,390	647
Land Disposals	-	-
Hydromodification	3,445	17,418
Habitat Modification	-	-
Marinas	-	-
Atmospheric Deposition	-	-
Contaminated Sediments	-	-
Unknown Source	0	0
Natural Sources*	18,998*	36,256*
Other (specify)	-	-

- = Category applicable, no data available.

* = Refers mainly to in-lake ecophysiological processes (processes secondary to eutrophication, for instance), wind resuspension phenomena, and climate variations, with very little actual background pollution loading from watersheds included.

Table 8. Trophic State Trends in Lakes (% of total in parentheses)

CATEGORY	NUMBER OF LAKES	ACREAGE OF LAKES
Assessed for Trends	307 (100%)	181,337 (100%)
Improving	7 (2.3%)	7,497 (4.1%)
Stable	84 (27.4%)	123,554 (68.1%)
Degrading	31 (10.1%)	37,383 (20.6%)
Trend Unknown	185 (60.2%)	12,903 (7.2%)

Wetlands Assessment

Extent of Wetland Resources

The wetland acreage reported for the current 305(b) reporting cycle amounts to 35,607 acres. All else remains similar to the 1996 305(b) report.

Integrity of Wetland Resources

Out of the 35,607 wetland acres (35 wetlands total) assessed during this reporting cycle, 25,069 acres (9 wetlands total) are considered to be monitored sites. This represents 70% of the total acres reported, and 26% of the total number of reported wetlands. An additional 10,538 acres of wetland are reported as evaluated (26 wetlands, 74% of the total).

As indicated earlier, the vast majority of the wetlands within the state are on private lands. Using the best statewide historic estimate from 841,000 acres, Kansas should contain between 360,000 and 435,000 acres of wetlands. This suggests that only about 8.2-to-9.9% of the state's wetland acres are assessed.

At a minimum wetlands are designated for noncontact recreation, food procurement, and aquatic life support uses. Wetlands are not generally designated for other uses in Kansas. Overall aquatic life use support (acute criteria only) is as follows, in terms of total reported acreage (monitored and/or evaluated sites): 10,197 acres are fully supported but threatened (29%), 1,875 acres are partially supported (5%), and 23,535 acres are not supported (66%). These numbers refer only to exceedences of acute aquatic life support criteria, although numbers were not significantly different when chronic criteria were analyzed.

Levels of noncontact recreational use support are as follows, in terms of reported acreage: 11,713 acres are fully supported but threatened (33%), 23,801 acres are partially supported (67%), and 93 acres are not supported (<1%). While no wetlands have been assessed for fish tissue pollutant burdens, the KDHE “human health” criteria are used here as a surrogate. Using this methodology, food procurement use support in Kansas wetlands is as follows: 32,249 acres are fully supported but threatened (91%), 2,000 acres are partially supported (<6%), and 1,358 acres are not fully supported (<4%).
The major causes of partial and/or nonsupport of designated uses in Kansas' wetlands are

excessive nutrient load, flow alterations, low dissolved oxygen, and turbidity/siltation. The major sources of partial and/or nonsupport of designated uses are agriculture, hydromodifications in watersheds, and natural processes (wetland ecophysiological processes and natural climate variations).

Out of the 25,069 monitored wetland acres in Kansas, 100% are monitored for toxics (heavy metals, pesticides, and ammonia). Due to a special wetland assessment project, a large number of normally evaluated wetlands are being assessed for toxics through the year 2000. During this reporting cycle, 1,265 acres of wetlands were impacted by toxics (4% of reported acres).

During this reporting cycle, 23,799 wetland acres were assessed as hypereutrophic (66.8%), 1,105 acres were assessed as slightly-to-very eutrophic (3.1%), 111 acres were assessed as mesotrophic (0.3%), and 9,092 acres were not assessed for trophic state (25.5%). Another 1,500 acres were assessed as argillotrophic (4.3%). Out of the reported wetland acres, trends in trophic status were as follows: 52.5% were stable over time (18,699 acres), 17.7% were degrading over time (6,295 acres), and trends in 29.6% (10,538 acres) were unknown. Only 75 acres showed measurable improvement in trophic status over time (0.2%).

Development of Wetland Water Quality Standards

No change from the 1996 305(b) report.

Additional Wetland Protection Activities

KDHE has received an EPA Wetland Protection Grant, which will allow for detailed assessments of baseline water quality, wetland functions, and resource values for 32 of the 35 wetlands discussed within this report. This project will continue through 2001. Otherwise, there are no significant changes in this report section since the 1996 305(b) report.